TOWER APPARATUS

CROSS REFERENCES TO RELATED APPLICATIONS: U.S. Provisional Application for Patent 60/400,903, filed 08/02/02, with title, "Tower Apparatus" which is hereby incorporated by reference. Applicant claims priority pursuant to 35 U.S.C. Par. 119(e)(i).

Statement as to rights to inventions made under Federally sponsored research and development: Not Applicable

BACKGROUND OF THE INVENTION

1. Field of the Invention.

This present invention relates to a means of increasing the load capacity of a tower and in particular, an apparatus and method for increasing the load capacity and stability of the tower to support the weight of additional communication equipment as well as the environmental forces exerted on the tower.

2. Brief Description of Prior Art.

Single-pole towers, also referred to as monopole towers are used in the telecommunications industry. In particular, such towers are used to support equipment for wireless phones and other communication devices.

The increase in wireless communications has resulted in an increase of mounted communication equipment of all kinds. Not only do wireless service providers need to install equipment covering new geographic areas, competing wireless service providers

need to install additional equipment covering the same or similar geographic areas. The solution to the foregoing problem is to either purchase additional land to erect new towers, or install additional equipment on existing towers. Purchasing land to install additional towers is increasingly expensive, as well as the expense associated with the construction and the maintenance of a new tower.

Towers are designed generally to support the weight of the communications equipment originally installed on the tower, as well as to withstand forces exerted on the tower by environmental factors, such as wind and ice, for example. Towers are generally not designed with sufficient stability to enable the tower to allow for the installation of additional equipment. As a result, prior art methods of increasing the stability of the tower in order support additional equipment are known to consist basically of familiar, expected and obvious structural configurations, typically reinforcing the weak area of the tower (the area where the additional equipment is to be installed) by means of a weld repair, such as an overlay of welding material. Installing the welding material can be done manually, or by using an automatic welding machine.

Therefore, it can be appreciated that there exists a continuing need for an apparatus and method for increasing the load capacity and stability of a tower to enable the tower to support the weight of additional communication equipment as well as the environmental forces exerted on the tower.

As will be seen from the subsequent description, the preferred embodiments of the present invention overcome limitations of monopole tower arrangements.

SUMMARY OF THE INVENTION

With the proliferation of cell phones and personal communications devices comes the need for towers to support additional equipment for wireless phone and other communication devices.

The present invention is designed to increase the load capacity and stability of a tower to enable the tower to support the weight of additional communication equipment as well as well as the environmental forces exerted on the tower. The preferred embodiment generally includes upper and lower collar assemblies disposed about the tower and mounted to the tower, vertical flat bars attached to the collar assemblies, at least one ring disposed between the upper and lower collar assemblies and wrapped around the tower and vertical flat bars to hold the bars in compression with the tower.

The presence of the tower support elements of the present invention increases the load capacity and stability of the tower. Specifically, the vertical flat bars provide reinforcement to the tower to allow for the installation of additional equipment.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a preferred embodiment of the present invention, a tower apparatus.

Fig. 1A is a front view of the tower apparatus of Fig. 1.

Fig. 2 is an enlarged view of a component of the tower apparatus of Fig. 1, namely, a collar with attachments.

Fig. 3 is an enlarged view of components of the tower apparatus of Fig. 1, namely the collar of Fig. 2 and a ring with attachments.

Figs. 4 is an exploded view of the collar and attachments of Fig. 2.

Fig. 5 is an exploded enlarged view of the collar and attachments of Fig. 2.

Fig. 6 is an exploded view of the ring and attachments of Fig. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 1 - 6 illustrate a preferred embodiment of a tower apparatus 1 made in accordance with the present invention. In the preferred embodiment, the tower apparatus 1 is attached to a tower 100 at selected locations to maximize the strength and reinforce the tower 100, to enable the tower 100 to support the weight of additional communication equipment (not shown) as well as the environmental forces exerted on the tower 100.

Fig.1 best discloses the tower 100 in accordance with the prior art. The tower 100 is generally attached to a foundation 110 and is comprised of a solid sheet of formed metal that forms a structure capable of supporting the various communication equipment that may be attached to the tower 100.

In general, the towers 100 are designed generally to support the weight of the communications equipment originally installed on the tower 100, as well as to withstand forces exerted on the tower 100 by environmental factors, such as wind and ice, for example. The towers 100 of the prior art are generally not designed with sufficient stability to enable the tower 100 to allow for the installation of additional equipment. The tower apparatus 1 is designed to attach to the tower 100 at selected locations where additional equipment will be installed in order to maximize the strength and provide reinforcement to the tower 100.

The tower apparatus 1 generally includes at least upper and lower collar assemblies 30. The collar assembly 30 is formed of a pair of joined collars 3 as shown in Figs. 2 - 4 and 5. Each joined pair of collars 30 wraps around the tower 100. The tower apparatus 1 further includes vertical flat bars 4 attached to the upper and lower joined pair of collars 30, and at least one ring 5 with ring attachment means 7 disposed between the upper and lower pairs of joined collars 30.

As best shown in Figs. 2 - 3, each joined pair of collars 30 are selectively positioned along the length of the tower 100 in order to add support to that area of the tower 100 where additional communication will be installed. Each collar assembly 30 includes tab plates 30A, and each collar 3 include a collar mount plate 3A formed on opposite ends of the collar 3. As shown in the drawings, the collar mount plates 3A of the pair of collars 3 are joined with mounts 30B to form the collar assembly 30. The joined collars 30 wrap around the tower 100. In the preferred embodiment, an upper collar assembly 30 is selectively positioned on the tower 100 as discussed above, and a lower collar assembly 30 is selectively positioned on the tower 100 so that the location of the upper collar assembly 30 is the approximate upper region of the tower 100 where added support is needed, and the lower collar assembly 30 is the approximate lower region of the tower 100 where added support is needed.

As best shown in Fig. 2, mounting blocks 30C are selectively positioned between the collar assembly 30 and the outer surface of the tower 100. The mounting blocks 30C include a flat portion 30D. Preferably the flat portion 30D of the mounting blocks 30C are attached to the outer surface of the tower 100 and the inner surface of the collar assembly 30 by welding, thereby securing the collar assembly 30 to the tower 100. While the preferred method of attaching the collar assembly 30 to the tower 100 is by welding the mounting blocks 30C therebetween as discussed above, any other method capable of securing the collar assembly 30 to the tower 100 should be suitable for implementing the present invention. Each of the collars 3 is shaped such that the joined pair of collars 30 fit around the tower 100 and such that the inner surface of the collar assembly 30 is in contact with the flat portion 30D of the mounting blocks 30C when the blocks 30C are secured to the collar assembly 30 and the tower 100 as discussed above.

As best shown in Figs. 3 - 5, the vertical flat bar 4 vertically extends along the length of the tower 100. In particular the flat bar 40 vertically extends the distance between the upper joined pair of collars 30 and the lower joined pair of collars 30. Each end of the

flat bar 4 is attached to the tab plates 30A of the collar assembly 30 that are fixedly attached to the outer surface of the collar assembly 30. In the preferred embodiment, bolts and nuts are used to attach the end of the flat bar 4 to the tab plate 30A.

As shown in the drawings, the ring 5 further wraps around the tower 100 parallel to the collar assembly 30. In particular, the ring 5 encircles the vertical bars 4 and the tower 100, holding the vertical bars 4 in compression with the tower 100. The rings 5 are spaced at intervals along the tower 100 between the upper collar assembly 30 and the lower collar assembly 30. As best shown in Fig. 6, the ring 5 includes a ring plate 5A disposed on opposite ends of the ring 5. Attachment means preferably including a threaded rod 7, a washer 7A, and nut 7B effectively attach the ring plates 5A of the ring 5 together so that the ring 5 wraps around the tower 100 as described above. In the preferred embodiment, the rings 5 are spaced apart along the tower 100 at intervals of approximately two (2) feet.

In the preferred embodiment the collars 3 forming the collar assembly 30 are fabricated from angle iron. Further, as illustrated in Figs. 1 and 1A, multiple collar assemblies 30 may be mounted along the length of the tower 100. As a result, shorter lengths of bars 4 can be used for easier field assembly, with the pair of joined collars 30 at each end of the set of bars 4. Each upper and lower collar assembly 30 secured to the tower 100 as previously described will enable the tower 100 to provide additional support and stability provided by the tower apparatus 1 to the tower 100.

To maximize the support and stability provided by the tower apparatus 1 to the tower 100, it is desirable to select the location of each upper and lower collar assembly 30 based on the design of the tower 100 and the location where each communication equipment is to be installed. In this regard, it is desirable to place the tower apparatus 1 at the location on the tower 100 needing the reinforcement. Instruments are available to determine the stresses in the walls of the tower 100. The results of the measurements can be used to determine the required elongation or number of pairs of

upper and lower collar assemblies 30, bars 4 and rings 5 that are required to reinforce the tower 100 for installation of additional accessories. As such, the number of collar assemblies 30 with bars 4 and rings 5 therebetween, installed on the tower 100 is as necessary, and may be situated along the entire vertical axis of the tower 100.

As shown in Fig. 1, the tower apparatus 1 may further include a base flange 31 positioned at the lower end of the tower 100 attached to the foundation 110. The base flange 31 includes brackets similar in design to the tab plates 30A of the collar assembly 30. The brackets of the base flange 31 for receiving an end of the flat bar 4 when additional support for the tower 100 is required at the lower region of the tower 100 .

As an example, referring to Fig. 1A, the tower apparatus 1 is illustrated having the upper collar assembly 30 and the base flange 31, designated as A1 attached to the tower 100 at the area designated W1 needing reinforcement; a second collar assembly 30 designated as A2 is attached to the tower 100 at the area designated W2 needing reinforcement; and a third collar assembly 30 designated as A3 is attached to the tower 100 at the area designated W3 needing reinforcement. As shown in Fig. 1A, the same collar assembly 30 may be used to reinforce an area above the collar assembly 30 such as the area designated as W3, and to reinforce an area below the collar assembly 30 such as the area designated as W2. In this regard, the tab plates 30A of the collar assembly 30 that receives the end of the vertical flat bar 4 are designed to receive an end of the flat bar 4 supporting the upper area relative to the collar assembly 30, and to further receive an end of the flat bar 4 supporting the lower area relative to the collar assembly 30. As shown in Fig. 3, in this application, the end of the flat bar 4 supporting the upper area is in abutting relationship with the end of the flat bar 4 supporting the lower area.

By installing multiple collar assemblies 30 as described above, shorter lengths of flat bars 4 may be used for easier field assembly, and to increase the strength of the tower

apparatus 1 and tower 100. As a result, it is possible to attach communication equipment and/or other types of loads directly to the tower 100. Such loads may be attached the tower 100 at any point along the vertical length of the installed tower apparatus 1.

By installing the tower apparatus 1 to the tower 100 as described above, bending moments experienced by the tower 100 may be passed into and absorbed by the tower apparatus 1, thereby increasing the load capacity and stability of the tower 100, to enable the tower 100 to support the weight of additional communication equipment as well as the environmental forces exerted on the tower.

The tower apparatus 1 may be installed on towers which are not yet installed or which is not vertical, or on previously installed towers.

Metal, such as steel or aluminum, is the preferred material of construction of the preferred embodiment of the collars 3 forming the collar assemblies 30, the bars 4, and the rings 5. If aluminum is used for the vertical flat bars 4, passivators are required.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention.

It will be obvious to those skilled in the art that modifications may be made to the embodiments described above without departing from the scope of the invention. Thus the scope of the invention should be determined by the claims in the formal application and their legal equivalence, rather than by the examples given.